PLEASANT AND RIDDLES LAKES

St. Joseph County

2006 Fish Management Report

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EXECUTIVE SUMMARY

- Pleasant (29 acres) and Riddles (77 acres) Lakes are two natural lakes located near Lakeville in St. Joseph County, Indiana.

- A standard fisheries survey on Pleasant and Riddles Lake was conducted from June 26 to June 27, 2006. Fish were collected using three sampling gears; electrofishing, gill nets and trap nets. Aquatic vegetation was sampled twice on both lakes in May and August, 2006.

- A largemouth bass population estimate was conducted on both lakes in a four-week period beginning in late-April through mid-May, 2006.

- A roving creel survey was conducted from May 1 through September 30, 2007. A creel clerk worked one, 7.5-h shift on ten randomly selected days per two-week period.

- The Pleasant Lake fisheries survey collected a total of 248 fish that weighed an estimated 92 lbs representing ten species (Table1). The Riddles Lake survey collected a total of 593 fish that weighed an estimated 276 lbs representing 15 different species and one hybrid (Table 2).

- Coontail and Eurasian watermilfoil were the most abundant species of vegetation in both Pleasant and Riddles Lake. Curlyleaf pondweed was found in both lakes in May, but was only present in Riddles Lake by August.

- A total of 1,068 largemouth bass were collected in four nights from late-April to mid-May, 2006 in Pleasant and Riddles Lakes (Table 3). The population estimate for largemouth bass 8.0 in TL and larger for both Pleasant and Riddles Lakes was 2,487 bass or 23.5 bass/acre.

- A total of 412 interviews were conducted from May 1 to September 30, 2006 at Pleasant and Riddles Lakes. Overall, 76% of anglers were from St. Joseph County.

- Estimated total angler harvest was 15,800 fish (149.1 fish/ac) in 11,917 h (1.33 fish/h) of fishing. Total fishing effort was 112.4 h/ac during the entire creel survey.

- Anglers harvested an estimated 13,982 bluegill ranging from 5.0 to 9.4 in, but the majority of fish harvested were between 7.0 and 8.0 in (Figure 1).

- Eighteen percent of anglers targeted bass. Total estimated catch was 3,536 bass and an estimated 1,028 were harvested. Seventy-one percent of bass caught were released.

- An estimated 596 crappie were caught during the angler survey and 453 crappie between 5.0 and 11.5 in were harvested (Figure 3).

- Implementation of an annual walleye stocking program using DFW-produced fish is recommended. Up to 10 advanced fingerling walleye per acre should be stocked into Pleasant and Riddles Lakes. Survival of stocked walleye should be evaluated according to standard evaluation guidelines.

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INTRODUCTION

Pleasant (29 acres) and Riddles (77 acres) Lakes are two natural lakes located near Lakeville in St. Joseph County, Indiana. These lakes are two of four lakes in the Heston Ditch chain. Lakes in this chain include Moon (the uppermost lake), Pleasant, Dipper, and Riddles (lowermost lake in the chain). A state-owned public access site is located on the north end of Pleasant Lake, on the south side of U.S. 31. This access site provides access not only to Pleasant Lake, but also to Dipper Lake and Riddles Lake via the channel on the south end of Pleasant Lake. Located adjacent to the public access site on Pleasant Lake is Kelly's Bait Shop which rents boats and electric trolling motors. Another boat launch is owned and operated by the Lakeville Conservation Club (LCC). This ramp is located on the northeast corner of the lake and is for LCC members only.

Pleasant and Riddles Lakes were stocked with channel catfish in 1979, tiger muskellunge in 1981, 1983, and 1985, and hybrid striped bass in 1991 and 1992. Additionally, LCC has stocked hybrid bluegill and walleye. Stocking records are incomplete, but an LCC representative stated that stocking has been regular since the late 1990's and has consisted of approximately four hundred 5-7" hybrid bluegill and two hundred 6-8" walleye fingerlings annually (Price 2004; Price 2005).

The Division of Fish and Wildlife (DFW) began fisheries management work on Pleasant Lake in 1972 and Riddles Lake in 1964. Pleasant Lake has been surveyed eight times with the most recent survey occurring in 2003 (Table 1). Riddles Lake has been surveyed five times with the most recent survey conducted in 2003 (Table 2). Additionally in both lakes, an antimycin gizzard shad selective was conducted in 1974 with a follow up evaluation in 1975.

The 2003 Pleasant Lake standard fish survey found the fishery to be providing good fishing opportunities. A total of 286 fish were collected that weighed 131.8 lbs from eleven different species. The most abundant species collected in the survey was bluegill comprising nearly 40% of the sample by number. Bluegills ranged in total length (TL) from 2.0 to 8.8 in and growth was slightly below average. Gizzard shad comprised 23% of the total sample in relative abundance by number. Largemouth bass were the third most abundant species collected (15%). Largemouth bass TL ranged from 7.8 to 19.0 in and growth was average. Redear sunfish were the fourth in overall abundance with individuals up to 8.3 in TL collected.

Similar to Pleasant Lake, the 2003 Riddles Lake standard fisheries survey found the fishery to be providing good fishing opportunities. A total of 401 fish were collected that weighed 168.0 lbs from sixteen different species. Bluegill was the most abundant species collected by number (59%). Bluegills TL ranged from 2.0 to 8.5 in and growth was good, reaching 7 in during the fourth year of life. Gizzard shad and largemouth bass comprised 16% and 10% of the relative abundance by number, respectively. Largemouth bass TL ranged from 4.9 to 21.7 in and growth was good with individuals reaching legal size (TL $\geq$ 14.0 in) during the fourth year of life. Additionally, seven walleyes were collected that ranged in TL from 10.2 to 22.2 in.

The Lakeville Business Owners Association has recently sponsored numerous studies on these lakes through the Lake and River Enhancement (LARE) program including a watershed diagnostic study, a sediment removal plan, and an aquatic vegetation management plan. The diagnostic study (Peel 2006) identified poor water quality as a major concern and recommended a combination of watershed and in-lake actions to begin to correct the problems with priority given to watershed management activities. The final recommendation was to implement the sediment removal plan only after the watershed issues had been addressed. Despite this recommendation, dredging in Pleasant Lake began in September, 2006 and was completed in December. An estimated 45,000 cubic yards of material was removed from Pleasant Lake in the four-month span.

Treatment of aquatic vegetation has been limited at these lakes. In 2005 and 2006 only 3 to 5 acres of chemical vegetation control was approved by DFW. For both Pleasant and Riddles Lakes, a LARE funded aquatic vegetation management plan was created for 2007-2011 (Long 2006). The report identifies the exotic species Eurasian watermilfoil, curlyleaf pondweed, and purple loosestrife as being potential nuisance problems within the lakes. The plan recommends chemical control to reduce Eurasian watermilfoil and curlyleaf pondweed within the lakes as well as limited control of nuisance natives to provide access for riparian owners.

The goal of the 2006 fisheries survey on Pleasant and Riddles Lake was to evaluate the fish community, estimate the largemouth bass population, and conduct an angler creel survey under work plan 204755.

METHODS

Standard Fisheries Survey

A standard fisheries survey on Pleasant and Riddles Lake was conducted from June 26 to June 27, 2006. Physical and chemical characteristics were collected in the deepest area of the lake according to the DFW sampling guidelines (Shipman et al. 2001). Aquatic vegetation was sampled twice on both lakes according to the DFW Tier II Aquatic Vegetation Survey Protocol (Pearson 2004).

Fish were collected using three sampling gears. Pulsed DC, shoreline electrofishing was conducted at night with two dippers for 0.5 h at Pleasant Lake and 0.75 h at Riddles Lake. Two trap nets and two gill nets were also fished overnight at Pleasant Lake. Two trap nets and four gill nets were fished overnight at Riddles Lake. All fish collected were measured to the nearest 0.1 in total length (TL) and separated into half-inch groups (X.0-X.4 for inch group and X.5-X.9 for half-inch group). Species specific length-weight regressions were used to estimate the total weight of all fish collected. Five scale samples were taken per half-inch group from the dominant sportfish for age and growth analysis. Catch per unit effort (CPUE) was calculated for the dominant sportfish collected as total catch divided by effort for each sampling gear. Proportional stock density (PSD) was calculated for largemouth bass and bluegill (Anderson and Neumann 1996).

Largemouth Bass Population Estimate

A largemouth bass population estimate was conducted at both lakes in a four-week period beginning in late-April through mid-May, 2006. One night of electrofishing was conducted each week during that period. Largemouth bass were collected along the entire shoreline of each lake as well as the stretch of Heston Ditch between Pleasant and Riddles Lakes. All bass collected upstream of the Linden Road crossing of Heston Ditch were included in the Pleasant Lake data, while fish collected downstream of the crossing were included in the Riddles Lake data. All bass were measured to the nearest 0.1 in TL, scale samples were collected for age and growth analyses, and marked with a pectoral fin clip for identification. Pleasant Lake bass were marked with a left pectoral (LP) fin clip, while Riddles Lake bass were marked with a right pectoral (RP) fin clip. On weeks two through four, each bass was inspected for the presence of a LP or RP fin clip to determine if the fish had been previously captured.

Initially, data from the Pleasant and Riddles largemouth bass population estimates were recorded separately. However, fin clip identification of bass recaptured during sampling indicated movement of largemouth bass between Pleasant and Riddles Lake. Therefore, the data for both lakes was pooled and treated as a single population for estimating population size because immigration or emigration violates the assumptions of the population estimate methods for a closed population. Population estimates and 95% confidence intervals (CI) were calculated using the Schnabel population estimation for two groups: all bass and stock-size and larger bass (TL $\geq$ 8.0 in) (Van Den Avyle and Hayward 1999).

Mortality estimates for largemouth bass were calculated using methods outlined by Van Den Avyle and Hayward (1999). An age-length key was generated to determine age-specific abundance of all bass collected during the population estimate sampling (DeVries and Frie 1996). The instantaneous mortality rate was estimated by linearizing age-specific bass abundance and creating a catch curve. The instantaneous mortality rate was used to calculate total annual mortality and annual survival of largemouth bass (Van Den Avyle and Hayward 1999). Largemouth bass age 2 and younger were under-represented in the sample and were therefore not included in the mortality estimate analysis.

Angler Creel Survey

A roving creel survey was conducted from May 1 through September 30, 2007. A creel clerk worked one, 7.5-h shift on ten randomly selected days per two-week period. Two shifts were created, 0630 h to 1400 h (A) and 1400 h to 2130 h (B), to cover the majority of the daylight period. Shift times were based on Eastern Daylight-Saving Time. During each shift, the clerk recorded four visual counts of all boat and shore anglers. This additional tier of stratification (boat vs. shore anglers) was included to improve the precision of effort estimates. Between counts, the clerk interviewed fisherman and recorded information about their fishing trip. One angler from each party was asked the following about their trip: start time, end time, target species, number and species harvested, number and species caught and released, county of residence, the quality of fishing at Pleasant and Riddles Lakes (good, fair, or poor), and if they had been interviewed previously. The clerk also inspected harvested fish to confirm species identification and measured a sub-sample of each species harvested. Lengths of fish measured were rounded to the nearest half-inch group (i.e. 6.0, 6.5, etc.).

Count and interview data were separated by type of day (i.e. weekday or weekend day). Per trip averages were calculated for fishing effort, number of fish harvested by species, and the number of fish caught and released by species. Average angler counts for each type of day were used to expand results to arrive at an overall estimate of effort, harvest, and catch and release for each month of the creel.

RESULTS

Standard Fisheries Surveys

The Pleasant Lake standard fisheries survey collected a total of 248 fish that weighed an estimated 92 lbs representing ten species (Table 1). The five most abundant species collected by number were gizzard shad (39%), bluegill (32%), largemouth bass (15%), white sucker (4%), and black crappie (4%). Relative abundance by weight was dominated by gizzard shad (36%), largemouth bass (28%), bluegill (12%), white sucker (9%), and walleye (6%).

A total of 96 gizzard shad was collected. Shad ranged in length from 3.2 to 14.1 in TL and averaged 9.2 in TL. A single age-0 gizzard shad was collected and 44% were age 1.

A total of 80 bluegills was collected from Pleasant Lake that weighed an estimated 10.8 lbs. Bluegill CPUE was highest for electrofishing (116.0 /h) then trap nets (10.0 /lift) and gill nets (0.5 /lift). Collected bluegills ranged in TL from 2.3 to 8.2 in and averaged 5.2 in. Forty-nine percent of bluegills were between 4.5 and 6.0 in and 28% were considered harvestable (> 6.0 in TL). Bluegill PSD was 25. Age-3 bluegills comprised 45% of the sample and averaged 5.1 in, while ages ranged from 1 to 6.

Largemouth bass in Pleasant Lake was third in relative abundance by number and second by weight. During the standard survey, a total of 37 largemouth bass was collected that weighed an estimated 25.6 lbs. Largemouth bass CPUE was 70.0 /h for electrofishing and 0.5 /lift for both gill and trap nets. Bass TL averaged 9.9 in and ranged from 3.1 to 16.5 in. Largemouth bass PSD was 44. Legal largemouth bass (TL $\geq$ 14.0 in) accounted for 19% of the bass collected.

There were 10 black crappie collected from Pleasant Lake that ranged in TL from 5.8 to 10.4 in. Two year classes of black crappie were identified and crappie averaged 7.5 in by age 2 and 9.4 in by age 3. Eight redear sunfish were collected that ranged in TL from 3.0 to 8.5 in. There were three walleye collected ranging in TL from 15.2 to 19.7 in.

Aquatic vegetation in Pleasant Lake was sampled on May 17 and August 1, 2006. Overall, five and three species of submersed vegetation were collected in May and August, respectively. During both surveys coontail was the most common species collected and other species include northern watermilfoil, Eurasian watermilfoil, curlyleaf pondweed, and Chara. The maximum depth plants were found was 15.5 and 8.0 ft in May and August, respectively. The mean rake score for all sampling locations was 1.07 and 0.77 and the maximum number of species per site was four and two in May and August, respectively. Other species present during the surveys were Elodea, duckweed and watermeal.

The Riddles Lake standard fisheries survey collected a total of 595 fish that weighed an estimated 276 lbs representing 15 different species and one hybrid (Table 2). The five most abundant species collected by number were bluegill (34%), gizzard shad (34%), largemouth bass (9%), golden shiner (6%), and black crappie (3%). Relative abundance by weight was dominated by gizzard shad (43%), spotted gar (12%), largemouth bass (11%), bluegill (8%), and common carp (7%).

Bluegill was the dominant species collected by number in Riddles Lake. A total of 204 bluegills that weighed 22.2 lbs was collected. Bluegill CPUE was highest for electrofishing (249.3 /h), then gill nets (3.8 /lift) and trap nets (1.0 /lift). Collected bluegills ranged in TL from 1.6 to 8.1 in and averaged 4.7 in. Twenty-one percent of bluegills collected were considered harvestable ($\geq$ 6.0 in TL). Bluegill PSD was 20. Age-3 bluegills comprised 40% of the sample and averaged 5.4 in, while ages ranged from 1 to 6.

Gizzard shad was the second most abundant species collected during the survey by number and the most abundant by weight. Shad ranged in length from 4.9 to 14.7 in TL and averaged 11.7 in TL. Out of the 200 shad collected, 10% were age 1 and 67% were greater than 12.0 in TL.

Largemouth bass in Riddles Lake were third in overall relative abundance by number and weight. During the standard survey, 56 largemouth bass were collected that weighed an estimated 30.9 lbs. Largemouth bass CPUE for electrofishing was 73.3/h and 0.3 /lift for gill net while no fish were caught in the trap nets. Largemouth bass TL averaged 9.1 in and ranged from 1.2 to 16.3 in. Largemouth bass PSD was 41. Seven legal largemouth bass were captured during the standard survey.

There were 20 black crappie collected from Riddles Lake. Black crappie ranged in TL from 4.5 to 14.2 in and age from 1 to 6. Nineteen redear sunfish were collected that ranged in

TL from 2.8 to 8.4 in and age from 1 to 5. A total of 11 walleye was collected that ranged in TL from 8.6 to 22.4 in. Walleye ranged in age from 1 to 4 and age-2 fish averaged 15.7 in.

Aquatic vegetation in Riddles Lake was sampled on June 6 and August 1, 2006. Overall, six and five species of submersed vegetation were collected in June and August, respectively. During both surveys coontail was the most dominant species collected. Other species collected include Eurasian watermilfoil, curlyleaf pondweed, northern watermilfoil, leafy pondweed, Chara, Naiad, and other pondweed species. The maximum depth plants were found was 14.5 and 6.5 ft in May and August, respectively. The mean rake score for all sampling locations in May and August was 0.80 and 0.71, respectively. The maximum number species per site was three for both surveys.

Largemouth Bass Population Estimate / Mortality Estimates

A total of 935 largemouth bass ranging from 3.6 to 20.2 in TL was collected in four nights of electrofishing from late-April to mid-May, 2006 in Pleasant Lake and Riddles Lake (Figure 1). A total of 133 largemouth bass was recaptured (Table 3). The largemouth bass population estimate for Pleasant and Riddles Lakes was calculated from 822 bass that were 8.0 in TL and longer (Table 3). Eight inches for largemouth bass is defined as "stock length", or the length at which anglers will first catch bass. Therefore, the number of stock length and larger bass in Pleasant and Riddles Lake was 2,487 with a 95% confidence interval that ranged from 2,117 to 3,013. Overall, there was estimated to be approximately 23.5 bass/acre in Pleasant and Riddles Lake. The PSD of the pooled sample was 52.

Mortality estimates for largemouth bass were calculated using age-specific abundance (age-length key) generated during the population estimate sampling. Largemouth bass age 2 and younger were underrepresented in the sample and were therefore eliminated from the mortality estimate analysis. The age-length key revealed that six year classes were fully recruited to the sample (ages 3 through 8). The total annual mortality rate for largemouth bass estimated by linearizing age-specific abundance (catch-curve analysis) was 51% (Figure 2).

Angler Creel Survey

A total of 412 interviews were conducted from May 1 to September 30, 2006 at Pleasant and Riddles Lakes. Anglers visited the lakes from 14 counties and several states. Overall, 76% of anglers were from St. Joseph County. Of the anglers interviewed 74% had not been previously interviewed during this creel survey.

The majority (47%) of anglers were targeting "any" species, while 33% were targeting bluegill and 18% were targeting largemouth bass. Other species targeted were crappie, catfish, carp, and bowfin. During the angler interviews, parties were asked to rate the quality of fishing. Fifty-one percent of anglers rated the fishing as "good," 31% fishing as "fair," and 18% fishing as "poor." Explicit reasons for "poor" ratings were not collected.

Estimated total angler harvest was 15,800 fish (149.1 fish/ac) in 11,917 h (1.33 fish/h) of fishing. Total fishing effort was 112.4 h/ac during the entire creel survey. Fishing effort was the greatest in June and July with effort of 26.2 and 33.1 h/ac, respectively. Harvest from May to September averaged 1.33 fish/h with the highest harvest occurring in August (1.90 fish/h) and the lowest in May (0.52 fish/h). Eighty-eight percent of total observed harvest was bluegill, while harvest of largemouth bass was 6.5% (Table 4).

Bluegill was the primary species targeted and harvested (88%) for an estimated total harvest of 13,982 bluegill. Another 5,243 bluegills were released for an estimated total catch of 19,225 bluegills. Harvested bluegills ranged from 5.0 to 9.4 in, but the majority of fish harvested were between 7.0 and 8.0 in (Figure 3).

Largemouth bass were the second most sought species, as 18% of anglers targeted bass. Total estimated catch was 3,536 bass and 1,028 (29%) were estimated as harvested. Catch and release fishing accounted for 71% of total bass catch. Observed bass that were kept ranged in length from 10.0 to 20.5 in and 5% of bass harvested were below legal size (TL < 14.0 in) (Figure 4).

An estimated 596 crappie were caught (453 harvested) and harvested fish ranged in TL from 5.0 to 11.5 in (Figure 5). An estimated 312 redear sunfish were harvested ranging in length from 5.5 to 10.5 in (Figure 6). Other species harvested include pumpkinseed sunfish, yellow perch, channel catfish, and walleye accounting for less than 1% of total estimated harvest.

DISCUSSION

The work conducted by the Division of Fish and Wildlife on Pleasant Lake and Riddles Lake in 2006 showed that sportfish populations, namely largemouth bass and bluegill, are providing good fishing opportunities for anglers. Anglers harvested an estimated 13,982 bluegill and 1,028 largemouth bass during the 2006 fishing season. Anglers caught and released an additional 5,243 bluegill and 2,508 largemouth bass. Less than 1% of the estimated harvest included crappie, redear sunfish, and walleye.

Currently largemouth bass are providing good fishing opportunities for anglers. The inflated bass PSD observed in the 2003 surveys, 89 and 76 for Pleasant and Riddles, respectively, raised concerns of poor recruitment due to the presence of gizzard shad or a potentially untapped fishery resource. The targeted sampling effort of the spring bass population estimate diminished those concerns significantly. Age-length keys generated from the spring bass sample showed that recruitment is relatively stable and no year-class failures had occurred in recent years. The PSD of the pooled sample was 52 indicating good balance in the population size structure. Additionally, the creel survey showed that the bass population was far from under-exploited. While bass harvest as measured by the creel did appear to be quite high, mortality estimates from the catch-curve analysis revealed that total annual mortality at Pleasant and Riddles is similar other natural lakes in the region (Price 2006; Benson 2006), thus alleviating concerns of excessive harvest. While the cause of the high PSD observed in 2003 remains in question, variability in sampling conditions and/or recruitment in conjunction with a relatively small sample size may have contributed.

Despite a large biomass of gizzard shad, bluegills continue to provide good fishing opportunities for area anglers. Bluegill growth declined between 2003 and 2006 in both lakes however, it is still slightly above average with fish reaching a harvestable size (6.0 in TL) by age 4. The observed harvest of bluegill from the creel survey showed that anglers harvested good numbers of bluegill in excess of 7.0 in TL (Figure 4). Bluegill PSD declined from 60 to 25 in Pleasant Lake and from 33 to 20 in Riddles Lake between 2003 and 2006, respectively, but remains in the desirable range of 20 to 40. The increase in electrofishing CPUE for bluegill in Pleasant Lake (38.0 /h in 2003 to 116.0 /h in 2006) and in Riddles Lake (130.7 /h in 2003 to 249.3 /h in 2006) can account for some of the decline in bluegill PSD.

Gizzard shad continue to make up a significant portion of the fish community of Pleasant and Riddles Lakes. While shad can have tremendous impacts on gamefish populations, their presence here appear to have relatively negligible effects. Good gamefish catch rates and growth are solid evidence of this. However with relatively high abundance of shad, it would be desirable to convert more shad biomass into a resource usable by anglers..

Beginning in 1996 the LCC began a stocking program for advanced fingerling walleye. Walleye have been stocked annually with the exception of 2002. The stocking rate of walleye equates to approximately 2 or 3 fish per acre. Even though survival and growth of walleye remains good, at this stocking rate walleye are not likely contributing significantly to the decline

in gizzard shad abundance (Price 2004). An increased stocking of walleye would enhance predation pressure on shad and convert more of the shad biomass into a resource usable by anglers. In lieu of the small advanced fingerling walleye stocking, DFW should annually stock advanced fingerling walleye at Pleasant and Riddles Lakes at a rate of 10 fingerlings/acre. Annual fall electrofishing should also be conducted to evaluate survival of the stocked fish and potential success of the new strategy. Assuming the stocking is deemed successful, LCC should be encouraged to redirect expenditures of club funds towards habitat and water quality improvements in Pleasant and Riddles Lakes and their watersheds.

The dominant species of submersed aquatic vegetation in both lakes was coontail. The non native Eurasian watermilfoil increased by as much as 15% throughout the summer in both lakes. Curlyleaf pondweed was only found in Riddles Lake during the May Tier II survey. Funds from the LARE program have been awarded to the Lakeville Business Owners Association for control of these exotic species. Northern watermilfoil was identified in the 2006 survey. This plant, which is very similar to Eurasian watermilfoil, was not documented in 2003 and may have been overlooked in previous surveys. While the vegetation community is not overly diverse, it provides substantial benefits to the fish populations in both lakes. Additionally, emergent vegetation was present along most of the shoreline in both lakes and consisted primarily of spatterdock and white water lily. These emergent plants also provide good cover for fish and protect shorelines from erosion caused by wind and wave action. Riparian owners are encouraged to protect emergent vegetation so these vital habitats remain intact.

Overall, Pleasant Lake and Riddles Lake remain a hotspot for local anglers. Anglers can expect good fishing for largemouth bass and bluegill in both lakes. Other fish anglers might target include redear sunfish, crappie, or even walleye and yellow perch. Anglers should keep in mind that there is a 10 mile per hour speed limit on both lakes and to exercise caution when navigating the channel between lakes. Anglers are encouraged to release largemouth bass over 14 in which will help retain a high predator base, help sustain recruitment of younger year classes and provide additional predation on gizzard shad.

RECOMMENDATIONS

- Recommend initiating an annual walleye stocking program at Pleasant and Riddles Lakes using DFW-produced advanced fingerlings at a rate of 10 walleye per acre.

- Annual evaluations of walleye fingerling survival should be using conducted using standard fall electrofishing surveys.

- Encourage and provide technical assistance for local initiatives that will provide water quality and habitat benefits to Pleasant and Riddles Lakes.

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Table 1. Species collected by year as percent number and estimated weight from Pleasant Lake, St. Joseph County, Indiana. Additionally, sampling gear and effort among years is included for Pleasant Lake.

	2006		2003		1986		1978		1977		1972
Species	Num. (%)	Wt. (%)	Num. (%)	Wt. (%)	Num. (%)	Wt. (%)	Num. (%)	Wt. (%)	Num. (%)	Wt. (%)	Num. (%)
Gizzard shad	39.0	36.7	23.1	27.5	38.5	36.7	-	-	22.6	34.0	33.3
Bluegill	32.1	11.4	39.2	14.8	39.9	9.1	73.7	38.6	29.7	5.9	51.9
Largemouth bass	15.0	27.9	14.3	44.9	9.5	20.2	2.7	4.9	5.4	10.0	3.7
White sucker	4.5	8.9	-	-	3.0	10.1	3.9	17.4	7.5	8.4	3.7
Black crappie	3.7	2.7	-	-	2.0	2.0	7.1	8.9	19.7	7.9	1.9
Redear sunfish	3.3	2.6	14.0	6.0	-	-	-	-	-	-	-
Walleye	1.2	5.6	-	-	-	-	-	-	-	-	-
Bowfin	0.4	3.9	0.3	1.1	0.5	2.9	*	6.4	1.7	6.2	-
Warmouth	0.4	0.1	1.7	1.2	0.7	0.2	1.2	1.4	0.4	0.2	-
Spotted gar	0.4	0.2	0.7	1.3	0.7	4.0	-	-	1.7	4.6	-
Pumpkinseed sunfish	-	-	1.4	0.1	0.7	0.1	3.1	1.1	1.1	0.3	1.9
Yellow bullhead	-	-	0.3	0.7	0.5	0.5	-	-	0.8	0.6	-
Spotted sucker	-	-	0.3	0.8	0.1	0.5	-	-	-	-	-
White crappie	-	-	4.5	1.5	1.4	0.9	1.2	1.9	-	-	-
Golden shiner	-	-	-	-	1.3	0.5	2.0	1.1	5.4	1.7	1.9
Black bullhead	-	-	-	-	0.4	1.0	-	-	0.8	0.7	-
Channel catfish	-	-	-	-	0.2	4.9	-	-	-	-	-
Brown bullhead	-	-	-	-	0.2	0.7	2.4	7.1	-	-	-
Common carp	-	-	-	-	0.1	4.4	*	6.0	-	-	1.9
Northern pike	-	-	-	-	0.1	1.9	*	4.8	0.8	14.7	-
Redfin pickerel	-	-	-	-	0.1	0.1	-	-	0.4	*	-
Yellow perch	-	-	-	-	-	-	*	*	-	-	-
Shortnose gar	-	-	-	-	-	-	-	-	0.8	4.7	-
Brook silverside	-	-	-	-	-	-	-	-	0.4	*	-
Totals	248 fish	92.26 lbs.	286 fish	131.75 lbs.	840 fish	232.88 lbs.	255 fish	62.29 lbs.	239 fish	134.28 lbs.	54 fish

* Represents less than 0.1% of total

	Sampling Effort					
Gear	2006	2003	1986	1978	1977	1972
Electrofishing	0.5 h (DC)	0.5 h (DC)	1.0 h (AC)	1.0 h (AC)	1.3 h (AC)	1.0 h (AC)
Trap netting	2 lifts	2 lifts	2 lifts	1 lift	-	-
Gill netting	2 lifts	2 lifts	2 lifts	2 lifts	3 lifts	-

Table 2. Species collected by year as percent number and estimated weight from Riddles Lake, St. Joseph County, Indiana. Additionally, sampling gear and effort among years is included for Riddles Lake.

	2006		2003		1987		1985		1976		1974	1964
Species	Num. (%)	Wt. (%)	Num. (%)	Wt. (%)	Num. (%)	Wt. (%)	Num. (%)	Wt. (%)	Num. (%)	Wt. (%)	Num. (%)	Num. (%)
Bluegill	34.4	8.1	59.1	18.5	21.6	5.5	18.2	5.7	15.7	7.2	19.6	32.7
Gizzard shad	33.7	43.3	15.7	22.4	50.4	47.4	48.7	55.3	29.3	21.2	48.0	0.3
Largemouth bass	9.4	11.2	9.5	27.6	5.6	7.1	7.9	12.5	10.0	12.4	3.4	16.1
Golden shiner	6.1	1.0	-	-	1.3	0.4	2.0	1.1	9.3	5.6	8.4	6.8
Black crappie	3.4	2.9	1.0	0.6	9.2	5.8	5.8	3.6	18.6	13.8	2.1	10.8
Redear sunfish	3.2	1.7	2.5	1.4	-	-	-	-	-	-	-	-
Spotted gar	2.9	11.6	1.7	3.3	0.1	0.8	0.2	1.7	2.9	18.8	1.0	-
White sucker	2.7	4.5	1.2	4.2	1.9	6.4	0.8	1.5	1.4	3.1	3.1	2.6
Walleye	1.7	4.0	1.7	8.7	-	-	-	-	-	-	-	-
Brook silverside	0.7	*	-	-	-	-	-	-	-	-	-	-
Bowfin	0.5	4	0.5	6.4	0.3	6.7	-	-	-	-	0.3	-
Common carp	0.3	7.1	-	-	-	-	-	-	-	-	0.8	4.4
Pumpkinseed sunfish	0.3	0.1	1.7	0.4	1.3	0.2	0.7	0.1	2.1	0.9	1.8	6.0
Warmouth	0.3	0.1	2.5	1.5	1.0	0.1	1.7	0.8	3.6	1.1	2.3	2.4
Yellow perch	0.2	0.2	0.7	0.2	0.9	0.2	0.5	0.2	0.7	0.5	0.5	6.8
Hybrid sunfish	0.2	0.1	-	-	-	-	-	-	-	-	-	-
White crappie	-	-	0.7	0.8	3.6	2.0	10.6	2.6	-	-	-	1.7
Brown bullhead	-	-	0.2	0.5	1.4	3.5	1.4	3.7	1.4	1.6	2.6	4.5
Spotted sucker	-	-	0.2	0.4	-	-	-	-	2.1	10.0	2.3	3.3
Yellow bullhead	-	-	0.7	3.2	0.6	0.7	-	-	2.9	3.7	1.6	1.1
Black bullhead	-	-	-	-	0.3	0.7	0.7	1.9	-	-	2.1	-
Bigmouth buffalo	-	-	-	-	0.3	12.4	0.5	8.8	-	-	-	-
Grass pickerel	-	-	-	-	0.1	0.2	0.1	*	-	-	-	-
Channel catfish	-	-	-	-	-	-	0.1	0.3	-	-	-	-
Green sunfish	-	-	-	-	-	-	0.1	*	-	-	-	0.2
Common shiner	-	-	-	-	-	-	-	-	-	-	-	0.3
Totals	595 fish	276.33 lbs	401 fish	167.94 lbs.	787 fish	296.13 lbs.	861 fish	301.70 lbs.	140 fish	44.54 lbs.	383 fish	659 fish

* Represents less than 0.1% of total

Sampling Effort

Gear	2006	2003	1987	1985	1976**	1974	1964
Electrofishing	0.75 h (DC)	0.75 h (DC)	1.0 hours	1.0 h (AC)		1.5 h (AC)	4.5 h (AC)
Trap netting	2 lifts	4 lifts	6 lifts	4 lifts		-	-
Gill netting	4 lifts	4 lifts	6 lifts	4 lifts		6 lifts	4 lifts

**Sampling effort was not reported

Table 3. Largemouth bass population estimate and lower and upper 95% confidence interval (CI) for all bass and stock-size and larger bass (TL ≥ 8.0 in) collected weekly from late-April to mid-May 2006 in Pleasant and Riddles Lakes, St. Joseph County, Indiana.

All largemouth bass

Week	Unmarked Catch	Recaptures	Total Catch	Estimate	Lower 95% CI	Upper 95% CI
1	302	0	302			
2	276	35	311			
3	211	42	253			
4	146	56	202			
Total	**935**	**133**	**1,068**	**3,004**	**2,568**	**3,619**

Largemouth bass (TL ≥ 8.0 in)

Week	Unmarked Catch	Recaptures	Total Catch	Estimate	Lower 95% CI	Upper 95% CI
1	270	0	270			
2	240	34	274			
3	180	39	219			
4	132	53	185			
Total	**822**	**126**	**948**	**2,487**	**2,117**	**3,013**

Table 4. Species estimated as harvested and caught and released (C&R) by month with total estimated harvested, total estimated C&R, and total estimated catch (total harvest + C&R) during the May 1 to September 30, 2006 angler creel survey at Pleasant and Riddles Lake, St. Joseph County, Indiana.

	May		June		July		August		September		TOTAL		
Species	Harvest	C&R	Harvest	C&R	Harvest	C&R	Harvest	C&R	Harvest	C&R	HARVEST	C&R	CATCH
Bluegill	213	66	3,028	470	4,478	598	4,182	2,555	2,081	1,554	13,982	5,243	19,225
Largemouth bass	130	12	217	722	248	949	346	475	87	350	1,028	2,508	3,536
Crappie	256	113	41	0	63	27	9	0	84	3	453	143	596
Redear sunfish	49	0	44	0	163	0	52	44	4	12	312	56	368
Pumpkinseed sunfish	0	0	8	4	0	0	0	0	0	3	8	7	15
Yellow perch	0	0	0	17	4	0	4	0	0	0	8	17	25
Channel catfish	0	0	0	0	5	0	0	0	0	0	5	0	5
Walleye	4	0	0	0	0	0	0	0	0	0	4	0	4
Total	652	191	3,338	1,213	4,961	1,574	4,593	3,074	2,256	1,922	15,800	7,974	23,774

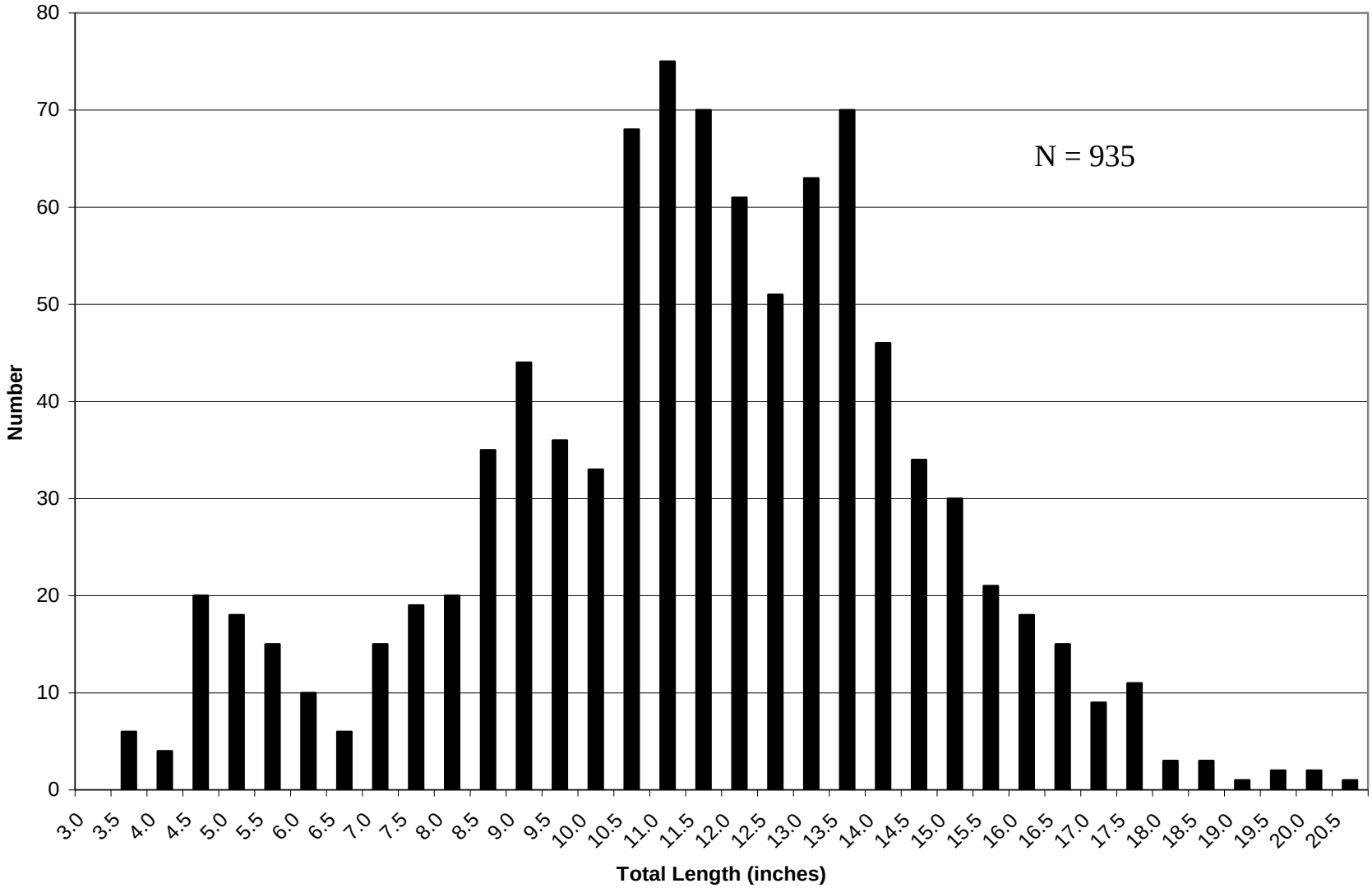

Figure 1. Length frequency of largemouth bass collected during the spring population estimate from Pleasant Lake and Riddles Lake, St. Joseph County, Indiana.

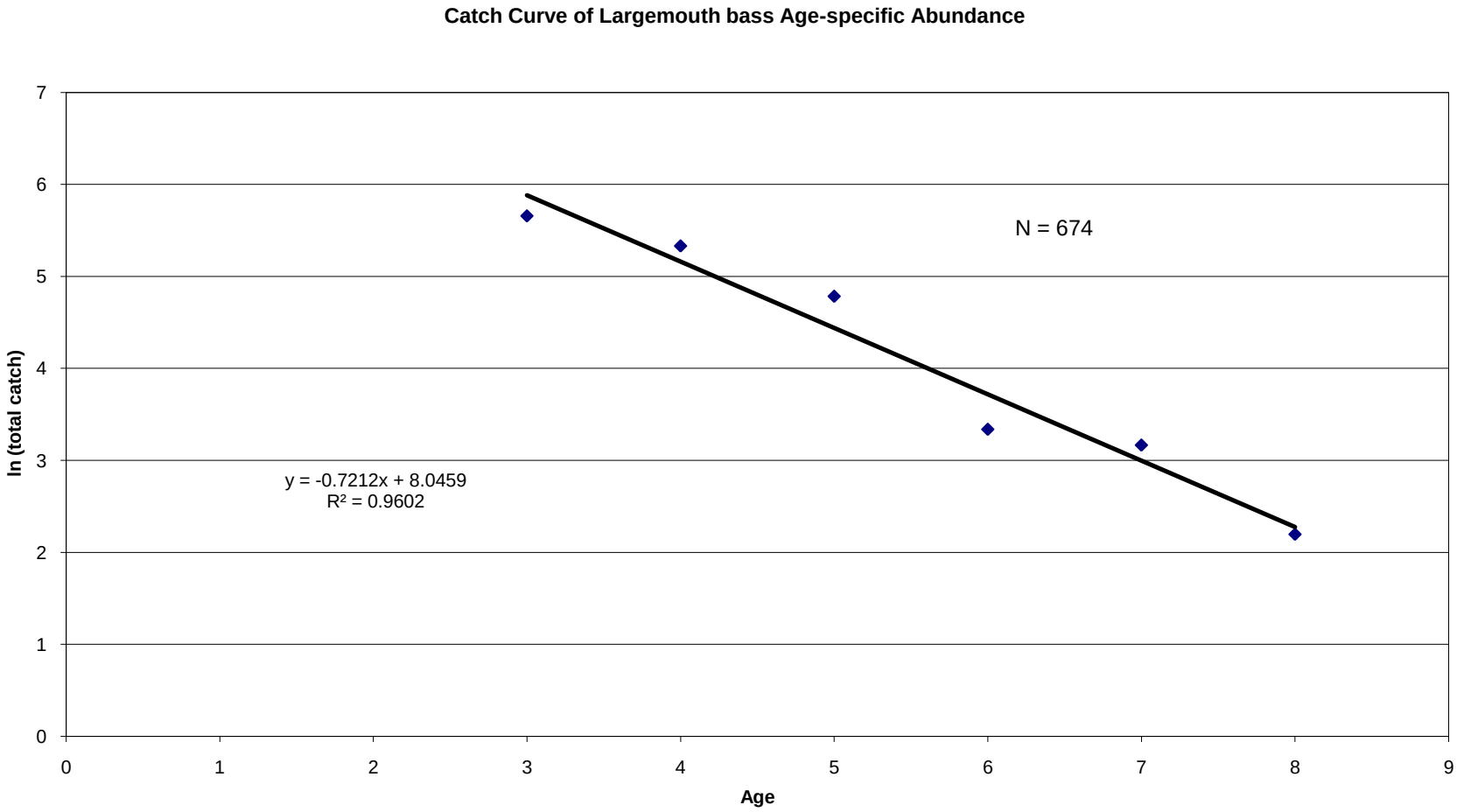

Figure 2. Linearized catch-curve of age-specific abundance for spring largemouth bass population estimate sampling in Pleasant Lake and Riddles Lake, St. Joseph County, Indiana.

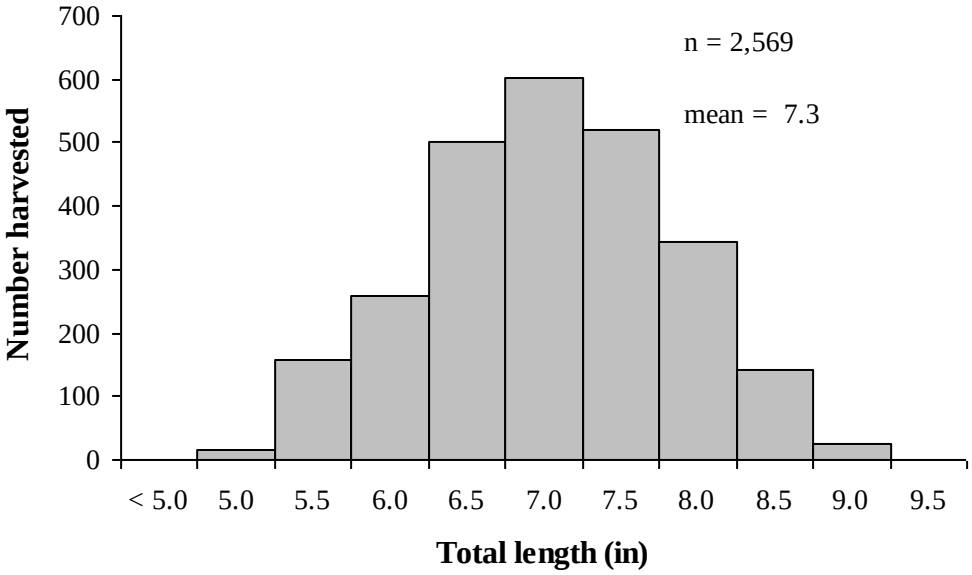

Figure 3. Observed harvest of 2,569 bluegill harvested during the May 1 to September 30, 2006 angler creel survey at Pleasant Lake and Riddles Lake, St. Joseph County, Indiana.

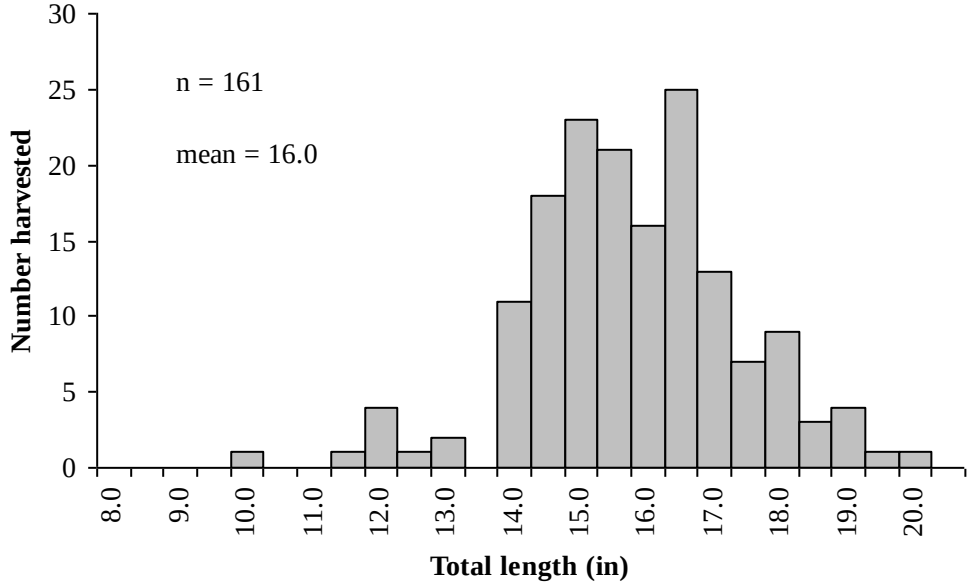

Figure 4. Observed harvest of 161 largemouth bass harvested during the May 1 to September 30, 2006 angler creel survey at Pleasant Lake and Riddles Lake, St. Joseph County, Indiana.

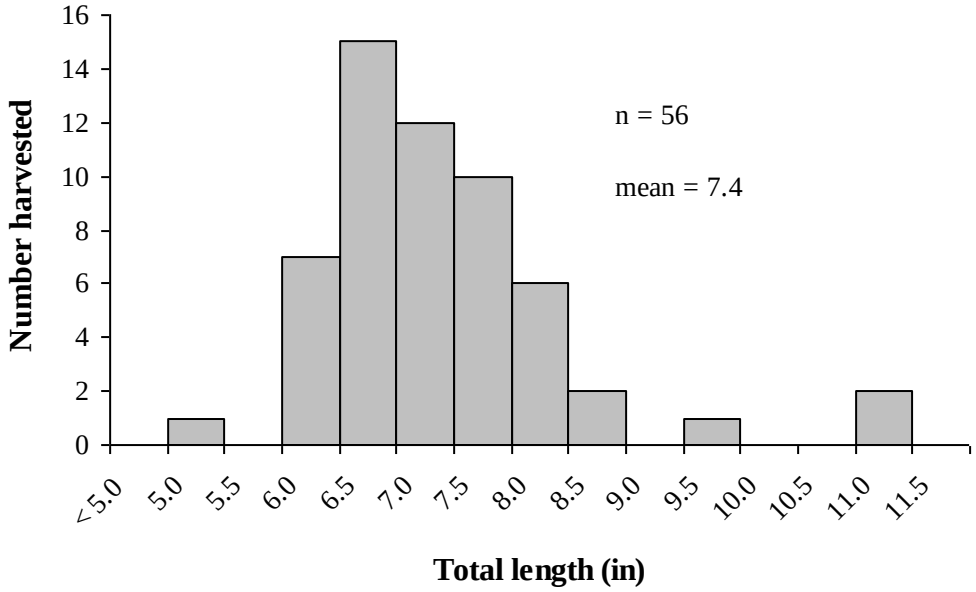

Figure 5. Observed harvest of 56 crappie harvested during the May 1 to September 30, 2006 angler creel survey at Pleasant Lake and Riddles Lake, St. Joseph County, Indiana.

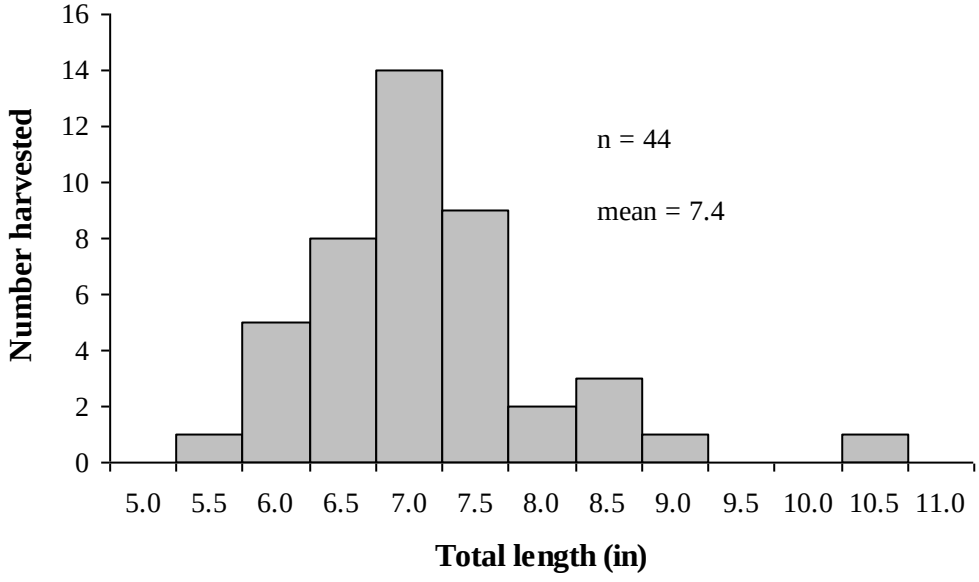

Figure 6. Observed harvest of 44 redear sunfish harvested during the May 1 to September 30, 2006 angler creel survey at Pleasant Lake and Riddles Lake, St. Joseph County, Indiana.

APPENDIX I

PLEASANT LAKE

LAKE SURVEY REPORT

Type of Survey: [ ] Initial Survey [X] Re-Survey

Lake name	County	Date of survey (Month, day, year)
Pleasant Lake	St. Joseph	June 26-27, 2006
Biologist's name		**Date of survey (Month, day, year)**
Bob Robertson & Jeremy Price		

LOCATION		
Quadrangle Name	Range	Section
Lakeville	2E	1
Township Name	Nearest Town	
35N	Lakeville	

ACCESSIBILITY					
State owned public access site			Privately owned public access site		Other access site
Located on north end, off U.S. 31			none		none
Surface acres	Maximum depth	Average depth	Acre feet	Water level	Extreme fluctuations
29	39 ft	17 ft	663	820 ft. MSL	1 ft.
Location of benchmark					
500 ft. northwest of Heston ditch					

INLETS		
Name	Location	Origin
Heston ditch	Northwest	Moon Lake

OUTLETS	
Name	Location
Heston ditch	Southeast
Water level control	
none	

POOL	ELEVATION (Feet MSL)	ACRES
TOP OF DAM		
TOP OF FLOOD CONTROL POOL		
TOP OF CONSERVATION POOL		
TOP OF MINIMUM POOL		
STREAMBED		

Bottom type

- [ ] Bolder
- [ ] Gravel
- [X] Sand
- [X] Muck
- [ ] Clay
- [ ] Marl

Watershed use

Primarily agricultural. Some residential to northeast. Forested and marshland to the west and northwest.

Development of shoreline

Minimal. Approximately 10% of shoreline developed.

Previous surveys and investigations

Electrofishing investigation 1972. Gizzard shad selective 1975. Fishery surveys 1977, 1978, 1986, 2003.

Channel catfish survey 1980, 1982, and 1984. Tiger Muskie surveys 1982 and 1984.

SAMPLING EFFORT					
ELECTROFISHING	Day hours		Night hours 0.5		Total hours 0.5
TRAP NETS	Number of traps 2		Number of Lifts 1		Total effort 2
GILL NETS	Number of nets 2		Number of Lifts 1		Total effort 2
ROTENONE	Gallons	ppm	Acre Feet Treated n/a	SHORELINE SEINING	Number of 100 Foot Seine Hauls none

PHYSICAL AND CHEMICAL CHARACTERISTICS	
Color: Brownish green	Turbidity: 2 Feet 0 Inches (SECCHI DISK)
Alkalinity (ppm)*: Surface: 86 Bottom: 86	pH: Surface: 9.5 Bottom: 9.5
Conductivity: 401 micromhos	Air temperature: 77 °F TDS 520
Water chemistry GPS coordinates: N 41.51584	W 86.27626

TEMPERATURE AND DISSOLVED OXYGEN (D.O.)								
DEPTH (FEET)	Degrees (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F	D.O. (ppm)
SURFACE	79.0	11.4	36			72		
2	77.0	11.6	38			74		
4	76.1	10.4	40			76		
6	75.4	9.6	42			78		
8	70.3	7.2	44			80		
10	66.0	4.1	46			82		
12	61.0	1.6	48			84		
14	57.2	0.5	50			86		
16	55.0	0.1	52			88		
18	52.0	0.2	54			90		
20	51.6	0.2	56			92		
22	51.1	0.1	58			94		
24	50.9	0.1	60			96		
26			62			98		
28			64			100		
30			66					
32			68					
34			70					

COMMENTS

*ppm-parts per million

Occurrence and Abundance of Submersed Aquatic Plants - Overall

Lake:	Pleasant	Secchi(ft):	6.3	SE Mean species / site:	0.21
Date:	5/17/2006	Littoral sites with plants:	17	Mean natives / site:	0.80
Littoral Depth (ft):	15.5	Number of species:	5	SE Mean natives / site:	0.15
Littoral Sites:	28	Maximum species / site:	4	Species diversity:	0.67
Total Sites:	30	Mean species / site:	1.07	Native diversity:	0.47

Species	Frequency of Occurrence	Score Frequency 0	1	3	5	Dominance
Coontail	57.1	53.3	16.7	3.3	26.7	40.0
Northern watermilfoil	25.0	80.0	20.0	0	0	5.7
Curlyleaf pondweed	17.9	83.3	16.7	0	0	3.6
Eurasian watermilfoil	10.7	90.0	10.0	0	0	2.1
Chara	3.6	96.7	3.3	0	0	0.7
Filamentous Algae	53.6					

Other species noted: Elodea

Occurrence and Abundance of Submersed Aquatic Plants - Overall

Lake:	Pleasant	Secchi(ft):	2.5	SE Mean species / site:	0.15
Date:	8/1/2006	Littoral sites with plants:	16	Mean natives / site:	0.60
Littoral Depth (ft):	8.0	Number of species:	3	SE Mean natives / site:	0.11
Littoral Sites:	20	Maximum species / site:	2	Species diversity:	0.46
Total Sites:	30	Mean species / site:	0.77	Native diversity:	0.20

Species	Frequency of Occurrence	Score Frequency 0	1	3	5	Dominance
Coontail	80.0	46.7	13.3	13.3	26.7	56.0
Eurasian watermilfoil	25.0	83.3	10.0	3.3	3.3	11.0
Northern watermilfoil	10.0	93.3	6.7	0	0	2.0
Filamentous Algae	35.0					

Other species noted: Duckweed, watermeal

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT					
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)	WEIGHT (pounds)	PERCENT
Gizzard shad	96	38.7	3.2-14.1	33.62	36.4
Bluegill	80	32.3	2.3-8.2	10.81	11.7
Largemouth bass	37	14.9	3.1-16.5	25.59	27.7
White sucker	11	4.4	8.0-14.0	8.12	8.8
Black crappie	10	4.0	5.8-10.4	2.70	2.9
Redear sunfish	8	3.2	3.0-8.5	2.35	2.5
Walleye	3	1.2	15.2-19.7	5.14	5.6
Bowfin	1	0.4	23.4	3.60	3.9
Warmouth	1	0.4	5.1	0.11	0.1
Spotted gar	1	0.4	12.6	0.22	0.2
Total (10 Species)	248			92.26	

*Common names of fishes recognized by the American Fisheries Society.

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Gizzard Shad									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0	1	1.0	0.02		21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0	2	2.1	0.06		23.0				
5.5	12	12.5	0.07		23.5				
6.0	11	11.5	0.09		24.0				
6.5	10	10.4	0.11		24.5				
7.0	7	7.3	0.13		25.0				
7.5					25.5				
8.0					26.0				
8.5					TOTAL	96			
9.0									
9.5	11	11.5	0.31						
10.0									
10.5									
11.0	6	6.3	0.47						
11.5	5	5.2	0.52						
12.0	5	5.2	0.59						
12.5	16	16.7	0.66						
13.0	9	9.4	0.72						
13.5									
14.0	1	1.0	0.91						
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	150 /h	GILL NET CATCH	10.5 /lift	TRAP NET CATCH	0 /lift

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Bluegill									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0	1	1.3	0.01	1	20.0				
2.5	6	7.5	0.02	1	20.5				
3.0	1	1.3	0.03	2	21.0				
3.5	4	5.0	0.05	2	21.5				
4.0	9	11.3	0.06	2, 3	22.0				
4.5	12	15.0	0.09	3	22.5				
5.0	15	18.8	0.12	3, 4	23.0				
5.5	12	15.0	0.15	3, 4	23.5				
6.0	7	8.8	0.18	4	24.0				
6.5	4	5.0	0.22	4, 5	24.5				
7.0	2	2.5	0.29	5	25.0				
7.5	4	5.0	0.33	5, 6	25.5				
8.0	3	3.8	0.40	5, 6	26.0				
8.5					TOTAL	80			
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	116.0 /h	GILL NET CATCH	0.5 /lift	TRAP NET CATCH	10.0 /lift

AGE-LENGTH KEY FOR Bluegill														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5														
2.0	1	1	1											
2.5	6	1	6											
3.0	1	1		1										
3.5	4	3		4										
4.0	9	7		6	3									
4.5	12	4			12									
5.0	15	5			12	3								
5.5	12	5			10	2								
6.0	7	2				7								
6.5	4	4				3	1							
7.0	2	2					2							
7.5	4	4					3	1						
8.0	3	2					1	2						
8.5														
Total	80	41	7	11	36	15	7	3						
Mean TL			2.7	4.0	5.1	6.1	7.6	8.1						
SE			0.07	0.10	0.08	0.13	0.18	0.20						

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Largemouth Bass (Spring)									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0	1	0.2	3.64	8
1.5					19.5	1	0.2	3.92	8
2.0					20.0				
2.5					20.5	1	0.2	4.47	10
3.0	1	0.2	0.02	1	21.0				
3.5	2	0.5	0.02	1	21.5				
4.0	2	0.5	0.05	1	22.0				
4.5	4	1.0	0.06	1	22.5				
5.0	6	1.4	0.08	1	23.0				
5.5	4	1.0	0.10	1	23.5				
6.0	1	0.2	0.15	1	24.0				
6.5	2	0.5	0.18	2	24.5				
7.0	13	3.1	0.21	2	25.0				
7.5	16	3.8	0.25	2	25.5				
8.0	12	2.9	0.30	2	26.0				
8.5	13	3.1	0.36	2	TOTAL	417			
9.0	19	4.6	0.42	2					
9.5	11	2.6	0.49	2, 3					
10.0	36	8.6	0.57	3					
10.5	34	8.2	0.65	3					
11.0	36	8.6	0.74	3					
11.5	26	6.2	0.83	3, 4					
12.0	25	6.0	0.96	4					
12.5	27	6.5	1.08	3, 4					
13.0	20	4.8	1.21	4, 5					
13.5	20	4.8	1.32	4, 5					
14.0	23	5.5	1.48	4, 5					
14.5	12	2.9	1.63	5, 6					
15.0	16	3.8	1.82	5					
15.5	7	1.7	1.98	5, 6					
16.0	9	2.2	2.18	6					
16.5	5	1.2	2.37	6, 7					
17.0	8	1.9	2.62	7, 8					
17.5	4	1.0	2.78	7					
18.0									
18.5									

ELECTROFISHING CATCH	139.0 /h	GILL NET CATCH	n/a	TRAP NET CATCH	n/a

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Largemouth Bass									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0	1	2.7	0.02		21.0				
3.5					21.5				
4.0					22.0				
4.5	1	2.7	0.06		22.5				
5.0	2	5.4	0.06		23.0				
5.5	2	5.4	0.08		23.5				
6.0	1	2.7	0.11		24.0				
6.5	1	2.7	0.15		24.5				
7.0	1	2.7	0.18		25.0				
7.5					25.5				
8.0	5	13.5	0.27		26.0				
8.5	2	5.4	0.33		TOTAL	37			
9.0	2	5.4	0.39						
9.5	2	5.4	0.46						
10.0	1	2.7	0.50						
10.5									
11.0	2	5.4	0.69						
11.5	1	2.7	0.82						
12.0	2	5.4	0.87						
12.5									
13.0	1	2.7	1.14						
13.5	3	8.1	1.21						
14.0	3	8.1	1.38						
14.5									
15.0	1	2.7	1.66						
15.5	1	2.7	1.83						
16.0	1	2.7	1.97						
16.5	1	2.7	2.24						
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	70 /h	GILL NET CATCH	0.5 /lift	TRAP NET CATCH	0.5/lift

AGE-LENGTH KEY FOR Largemouth Bass (Spring)														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5														
2.0														
2.5														
3.0	1	1	1											
3.5	2	1	2											
4.0	2	1	2											
4.5	4	3	4											
5.0	6	3	6											
5.5	4	2	4											
6.0	1	1	1											
6.5	2	2		2										
7.0	13	3		13										
7.5	16	6		16										
8.0	12	3		12										
8.5	13	1		13										
9.0	19	2		19										
9.5	11	3		7	4									
10.0	36	5			36									
10.5	34	3			34									
11.0	36	4			36									
11.5	26	5			16	10								
12.0	25	5				25								
12.5	27	4			7	20								
13.0	20	4				15	5							
13.5	20	2				10	10							
14.0	23	5				14	9							
14.5	12	4					9	3						
15.0	16	3					16							
15.5	7	4					2	5						
16.0	9	2					4	5						
16.5	5	3						2	3					
17.0	8	5							6	2				
17.5	4	2							4					
18.0														
18.5														
19.0	1	1								1				
19.5	1	1								1				
20.0														
20.5	1	1										1		
21.0														
21.5														
Total	417	95	20	82	132	94	55	14	14	4		1		
Mean TL			5.0	8.4	10.9	12.9	14.6	15.8	17.3	18.5		20.8		
SE			0.18	0.09	0.06	0.08	0.11	0.17	0.10	0.70		-		

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Black Crappie									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0					23.0				
5.5	1	10.0	0.10	2	23.5				
6.0					24.0				
6.5					24.5				
7.0	2	20.0	0.19	2	25.0				
7.5	2	20.0	0.23	2	25.5				
8.0	2	20.0	0.25	2	26.0				
8.5	1	10.0	0.31	3	TOTAL	10			
9.0	1	10.0	0.41	3					
9.5									
10.0	1	10.0	0.55	3					
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	1.3 /h	GILL NET CATCH	1.5 /lift	TRAP NET CATCH	3.0 /lift

AGE-LENGTH KEY FOR Black Crappie														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5														
2.0														
2.5														
3.0														
3.5														
4.0														
4.5														
5.0														
5.5	1	1		1										
6.0														
6.5														
7.0	2	2		2										
7.5	2	2		2										
8.0	2	2		2										
8.5	1	1			1									
9.0	1	1			1									
9.5														
10.0	1	1			1									
10.5														
11.0														
11.5														
Total	10	10		7	3									
Mean TL				7.5	9.4									
SE				0.32	0.44									

GILL NETS			TRAP NETS			ELECTROFISHING		
1	N 41.51678	W 86.27624	1	N 41.51467	W 86.27387	1	N 41.53670	W 86.27425
	N 41.51637	W 86.27556	2	N 41.51767	W 86.27893		N 41.51872	W 86.27721
2	N 41.51541	W 86.27660				2	N 41.51872	W 86.27721
	N 41.51558	W 86.27744					N 41.51513	W 86.27621

APPENDIX II

RIDDLES LAKE

LAKE SURVEY REPORT

Type of Survey: [ ] Initial Survey [X] Re-Survey

Lake name	County	Date of survey (Month, day, year)
Riddles Lake	St. Joseph	June 26-27 2006
Biologist's name		Date of survey (Month, day, year)
Bob Robertson & Jeremy Price		

LOCATION		
Quadrangle Name	Range	Section
Lakeville	2E	2 &11
Township Name	Nearest Town	
35N	Lakeville	

ACCESSIBILITY					
State owned public access site			Privately owned public access site		Other access site
On Pleasant Lake, via channel			Lakeville Conservation Club		
Surface acres	Maximum depth	Average depth	Acre feet	Water level	Extreme fluctuations
77	20 ft	8 ft	637	817.5 ft. MSL	less than 1 ft.
Location of benchmark					
South end of lake on the outlet dam structure					

INLETS		
Name	Location	Origin
Heston Ditch	Northwest corner	Pleasant Lake

OUTLETS	
Name	Location
Heston Ditch	Southeast corner
Water level control	
Fixed crest structure	

POOL	ELEVATION (Feet MSL)	ACRES
TOP OF DAM		
TOP OF FLOOD CONTROL POOL		
TOP OF CONSERVATION POOL		
TOP OF MINIMUM POOL		
STREAMBED		

Bottom type

- [ ] Bolder
- [ ] Gravel
- [X] Sand
- [X] Muck
- [ ] Clay
- [ ] Marl

Watershed use

Primarily agriculture with some residential and forested land.

Development of shoreline

Approximately 25% residential development with the majority occurring on eastern shore.

Previous surveys and investigations

USGS lake mapping survey 1955. Fishery Surveys 1964, 1974, 1976, 1985, 1987, 2003.

Gizzard shad selective 1975. Hybrid striped bass surveys 1989, 1990, 1991.

SAMPLING EFFORT					
ELECTROFISHING	Day hours		Night hours 0.75		Total hours 0.75
TRAP NETS	Number of traps 2		Number of Lifts 1		Total effort 2
GILL NETS	Number of nets 4		Number of Lifts 1		Total effort 4
ROTENONE	Gallons	ppm	Acre Feet Treated n/a	SHORELINE SEINING	Number of 100 Foot Seine Hauls none

PHYSICAL AND CHEMICAL CHARACTERISTICS	
Color: Brown	Turbidity: 2 Feet 6 Inches (SECCHI DISK)
Alkalinity (ppm)*: Surface: 86 Bottom: 86	pH: Surface: 9.5 Bottom: 9.5
Conductivity: 434 micromhos	Air temperature: 78 °F TDS 483
Water chemistry GPS coordinates: N 41.50497	W 86.26211

TEMPERATURE AND DISSOLVED OXYGEN (D.O.)								
DEPTH (FEET)	Degrees (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F	D.O. (ppm)
SURFACE	77.9	10.3	36			72		
2	77.2	10.6	38			74		
4	77.0	8.4	40			76		
6	76.8	7.3	42			78		
8	75.2	5.8	44			80		
10	67.8	3.1	46			82		
12	62.4	0.5	48			84		
14	61.2	0.4	50			86		
16	61.2	0.2	52			88		
18			54			90		
20			56			92		
22			58			94		
24			60			96		
26			62			98		
28			64			100		
30			66					
32			68					
34			70					

COMMENTS

*ppm-parts per million

Occurrence and Abundance of Submersed Aquatic Plants - Overall

Lake:	Riddles	Secchi(ft):	2.0	SE Mean species / site:	0.15
Date:	6/6/2006	Littoral sites with plants:	20	Mean natives / site:	0.50
Littoral Depth (ft):	14.5	Number of species:	5	SE Mean natives / site:	0.10
Littoral Sites:	37	Maximum species / site:	3	Species diversity:	0.66
Total Sites:	40	Mean species / site:	0.80	Native diversity:	0.34

Species	Frequency of Occurrence	Score Frequency 0	1	3	5	Dominance
Coontail	43.2	62.5	32.5	0	5.0	14.6
Curly-leaf pondweed	21.6	85.0	10.0	0	5.0	9.7
Eurasian water milfoild	10.8	92.5	7.5	0	0	2.7
Leafy pondweed	8.1	92.5	7.5	0	0	1.6
Chara	2.7	97.5	2.5	0	0	0.5
Filamentous Algae	40.5					

Other species noted:

Occurrence and Abundance of Submersed Aquatic Plants - Overall

Lake:	Riddles	Secchi(ft):	3.0	SE Mean species / site:	0.13
Date:	8/1/2006	Littoral sites with plants:	21	Mean natives / site:	0.51
Littoral Depth (ft):	6.5	Number of species:	6	SE Mean natives / site:	0.09
Littoral Sites:	27	Maximum species / site:	3	Species diversity:	0.54
Total Sites:	45	Mean species / site:	0.71	Native diversity:	0.24

Species	Frequency of Occurrence	Score Frequency 0	1	3	5	Dominance
Coontail	74.1	55.6	24.4	6.7	13.3	37.0
Eurasian water milfoil	29.6	82.2	11.1	4.4	2.2	11.9
Naiad sp.	3.7	97.8	0	2.2	0	2.2
Curly-leaf pondweed	3.7	97.8	2.2	0	0	0.7
Northern water milfoil	3.7	97.8	2.2	0	0	0.7
Pondweed sp.	3.7	97.8	2.2	0	0	0.7
Filamentous Algae	22.2					

Other species noted:

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT					
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)	WEIGHT (pounds)	PERCENT
Bluegill	204	34.3	1.6-8.1	22.18	8.0
Gizzard shad	200	33.6	4.9-14.7	119.17	43.1
Largemouth bass	56	9.4	1.2-16.3	30.85	11.2
Golden shiner	36	6.1	3.1-7.8	2.86	1.0
Black crappie	20	3.4	4.5-14.2	8.01	2.9
Redear sunfish	19	3.2	2.8-8.4	4.69	1.7
Spotted gar	17	2.9	13.3-34.5	32.04	11.6
White sucker	16	2.7	8.9-16.4	12.40	4.5
Walleye	11	1.8	8.6-22.4	12.14	4.4
Brook silverside	5	0.8	1.1-3.7	0.04	0.0
Bowfin	3	0.5	21.4-24.6	11.00	4.0
Warmouth	2	0.3	5.0-6.5	0.35	0.1
Pumpkinseed sunfish	2	0.3	5.6-5.8	0.30	0.1
Common carp	2	0.3	26.7-29.6	19.44	7.0
Yellow perch	1	0.2	11.4	0.58	0.2
Hybrid sunfish	1	0.2	6.9	0.28	0.1
Total (15 Species)	595			276.33	

*Common names of fishes recognized by the American Fisheries Society.

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Bluegill									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5	5	2.5	0.01	1	19.5				
2.0	13	6.4	0.01	1	20.0				
2.5	22	10.8	0.02	1, 2	20.5				
3.0	9	4.4	0.03	2	21.0				
3.5	16	7.8	0.05	2	21.5				
4.0	27	13.2	0.07	2, 3	22.0				
4.5	14	6.9	0.09	2, 3	22.5				
5.0	24	11.8	0.12	3	23.0				
5.5	31	15.2	0.15	3, 4	23.5				
6.0	19	9.3	0.19	3, 4	24.0				
6.5	12	5.9	0.23	3, 4	24.5				
7.0	6	2.9	0.27	4, 5	25.0				
7.5	4	2.0	0.33	4	25.5				
8.0	2	1.0	0.38	6	26.0				
8.5					TOTAL	204			
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	249.3 /h	GILL NET CATCH	3.8 /lift	TRAP NET CATCH	1.0 /lift

AGE-LENGTH KEY FOR Bluegill														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5	5	1	5											
2.0	13	1	13											
2.5	22	3	7	15										
3.0	9	2		9										
3.5	16	4		16										
4.0	27	7		12	15									
4.5	14	3		9	5									
5.0	24	4			24									
5.5	31	6			21	10								
6.0	19	4			14	5								
6.5	12	4			3	9								
7.0	6	5				5	1							
7.5	4	4				4								
8.0	2	2						2						
8.5														
Total	204	50	25	61	82	33	1	2						
Mean TL			2.3	3.7	5.4	6.6	7.3	8.3						
SE			0.07	0.09	0.08	0.12	-	-						

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Gizzard Shad									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5	1	0.5	0.05	1	22.5				
5.0	2	1.0	0.06	1	23.0				
5.5	2	1.0	0.08	1	23.5				
6.0	7	3.5	0.10	1	24.0				
6.5	5	2.5	0.12	1	24.5				
7.0	2	1.0	0.14	1	25.0				
7.5					25.5				
8.0					26.0				
8.5	1	0.5	0.26	2	TOTAL	200			
9.0	3	1.5	0.29	2					
9.5	15	7.5	0.33	2					
10.0	6	3.0	0.37	2					
10.5	7	3.5	0.42	2					
11.0	7	3.5	0.47	2, 3					
11.5	8	4.0	0.55	3					
12.0	38	19.0	0.61	3					
12.5	29	14.5	0.68	3+					
13.0	27	13.5	0.75	3+					
13.5	26	13.0	0.84	3+					
14.0	11	5.5	0.93	3+					
14.5	3	1.5	1.02	3+					
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	248.0 /h	GILL NET CATCH	4.5 /lift	TRAP NET CATCH	0 /lift

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Largemouth Bass (Spring)									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0	1	0.2	3.59	7
1.5					19.5	1	0.2	3.87	8
2.0					20.0	1	0.2	4.10	8
2.5					20.5				
3.0					21.0				
3.5	4	0.8	0.03	1	21.5				
4.0	7	1.4	0.04	1	22.0				
4.5	15	2.9	0.06	1	22.5				
5.0	11	2.1	0.08	1	23.0				
5.5	10	1.9	0.10	1	23.5				
6.0	10	1.9	0.13	1	24.0				
6.5	5	1.0	0.17	1	24.5				
7.0	5	1.0	0.20	1, 2	25.0				
7.5	3	0.6	0.25	2	25.5				
8.0	12	2.3	0.30	2	26.0				
8.5	27	5.2	0.35	2, 3	TOTAL	518			
9.0	23	4.4	0.42	2					
9.5	19	3.7	0.48	2, 3					
10.0	20	3.9	0.57	2, 3					
10.5	25	4.8	0.64	3					
11.0	44	8.5	0.74	3, 4					
11.5	35	6.8	0.84	3					
12.0	38	7.3	0.95	3					
12.5	32	6.2	1.08	4					
13.0	43	8.3	1.21	3, 4, 5					
13.5	32	6.2	1.33	4, 5					
14.0	28	5.4	1.48	4, 5					
14.5	18	3.5	1.65	5					
15.0	14	2.7	1.79	5					
15.5	9	1.7	2.01	5, 6					
16.0	10	1.9	2.18	5, 7					
16.5	5	1.0	2.36	6					
17.0	3	0.6	2.60	6, 7					
17.5	3	0.6	2.81	7, 8					
18.0	3	0.6	3.05	7					
18.5	2	0.4	3.27	7					

ELECTROFISHING CATCH	103.6 /hr	GILL NET CATCH	n/a	TRAP NET CATCH	n/a

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Largemouth Bass									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0	1	1.8			19.0				
1.5	1	1.8			19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0	6	10.7			23.0				
5.5	4	7.1			23.5				
6.0	1	1.8			24.0				
6.5	6	10.7			24.5				
7.0	2	3.6			25.0				
7.5	2	3.6			25.5				
8.0					26.0				
8.5					TOTAL	56			
9.0	3	5.4							
9.5	5	8.9							
10.0	1	1.8							
10.5	4	7.1							
11.0	2	3.6							
11.5	1	1.8							
12.0	5	8.9							
12.5	4	7.1							
13.0	1	1.8							
13.5									
14.0	5	8.9							
14.5	1	1.8							
15.0									
15.5									
16.0									
16.5	1	1.8							
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	73.3 /h	GILL NET CATCH	0.3/lift	TRAP NET CATCH	0.0 /lift

AGE-LENGTH KEY FOR Largemouth Bass (Spring)														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5														
2.0														
2.5														
3.0														
3.5	4	2	4											
4.0	7	6	7											
4.5	15	9	15											
5.0	11	7	11											
5.5	10	4	10											
6.0	10	4	10											
6.5	5	1	5											
7.0	5	2	2	3										
7.5	3	1		3										
8.0	12	5		12										
8.5	27	7		23	4									
9.0	23	6		23										
9.5	19	5		15	4									
10.0	20	4		15	5									
10.5	25	2			25									
11.0	44	6			37	7								
11.5	35	5			35									
12.0	38	3			38									
12.5	32	4				32								
13.0	43	6			7	29	7							
13.5	32	5				26	6							
14.0	28	3				19	9							
14.5	18	4					18							
15.0	14	4					14							
15.5	9	4					2	7						
16.0	10	4					8		2					
16.5	5	2						5						
17.0	3	3						2	1					
17.5	3	2							1	2				
18.0	3	1							3					
18.5	2	2							2					
19.0	1	1							1					
19.5	1	1								1				
20.0	1	1								1				
20.5														
21.0														
21.5	1	1								1				
22.0														
Total	519	127	64	94	154	112	65	14	10	5				
Mean TL			5.4	9.1	11.5	13.3	14.8	16.3	17.8	19.6				
SE			0.11	0.08	0.07	0.07	0.10	0.17	0.31	0.80				

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Black Crappie									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5	1	5.0	0.05	1	22.5				
5.0	5	25.0	0.07	1	23.0				
5.5					23.5				
6.0	2	10.0	0.11	1	24.0				
6.5					24.5				
7.0					25.0				
7.5	5	25.0	0.22	2	25.5				
8.0	1	5.0	0.25	2	26.0				
8.5					TOTAL	20			
9.0									
9.5									
10.0	1	5.0	0.53	3					
10.5									
11.0									
11.5	1	5.0	0.76	4					
12.0	1	5.0	0.90	4					
12.5									
13.0									
13.5	2	10.0	1.23	5, 6					
14.0	1	5.0	1.38	6					
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	0 /h	GILL NET CATCH	4.0 /lift	TRAP NET CATCH	2.0 /lift

AGE-LENGTH KEY FOR Black Crappie														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5														
2.0														
2.5														
3.0														
3.5														
4.0														
4.5	1	1	1											
5.0	5	5	5											
5.5														
6.0	2	2	2											
6.5														
7.0														
7.5	5	5		5										
8.0	1	1		1										
8.5														
9.0														
9.5														
10.0	1	1			1									
10.5														
11.0														
11.5	1	1				1								
12.0	1	1				1								
12.5														
13.0														
13.5	2	2					1	1						
14.0	1	1						1						
14.5														
Total	20	20	8	6	1	2	1	2						
Mean TL			5.4	7.8	10.3	12.0	13.8	14.0						
SE			0.19	0.08	-	0.25	-	0.25						

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Redear Sunfish									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5	2	10.5	0.02	1	20.5				
3.0	1	5.3	0.03	1	21.0				
3.5	3	15.8	0.04	1,2	21.5				
4.0					22.0				
4.5	1	5.3	0.08	3	22.5				
5.0					23.0				
5.5	1	5.3	0.17	3	23.5				
6.0					24.0				
6.5					24.5				
7.0	3	15.8	0.31	4	25.0				
7.5	2	10.5	0.34	4, 5	25.5				
8.0	5	26.3	0.43	4, 5	26.0				
8.5	1	5.3	0.48	5	TOTAL	19			
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	24.0 /h	GILL NET CATCH	0.3 /lift	TRAP NET CATCH	0 /lift

AGE-LENGTH KEY FOR Redear Sunfish														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5														
2.0														
2.5	2	2	2											
3.0	1	1	1											
3.5	3	3	2	1										
4.0														
4.5	1	1			1									
5.0														
5.5	1	1			1									
6.0														
6.5														
7.0	3	3				3								
7.5	2	2				1	1							
8.0	5	5				2	3							
8.5	1	1					1							
9.0														
Total	19	19	5	1	2	6	5							
Mean TL			3.3	3.8	5.3	7.7	8.3							
SE			0.22	-	0.50	0.20	0.16							

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Walleye									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0	1	9.1	4.07	4
4.5					22.5				
5.0					23.0				
5.5					23.5				
6.0					24.0				
6.5					24.5				
7.0					25.0				
7.5					25.5				
8.0					26.0				
8.5	3	27.3	0.15	1	TOTAL	11			
9.0									
9.5	1	9.1	0.24	1					
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5	1	9.1	0.97	2					
15.0	1	9.1	1.04	2					
15.5	2	18.2	1.19	2					
16.0	1	9.1	1.27	2					
16.5									
17.0									
17.5	1	9.1	1.73	3					
18.0									
18.5									

ELECTROFISHING CATCH	2.7 /h	GILL NET CATCH	2.3 /lift	TRAP NET CATCH	0 /lift

AGE-LENGTH KEY FOR Walleye														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
6.0														
6.5														
7.0														
7.5														
8.0														
8.5	3	3	3											
9.0														
9.5	1	1	1											
10.0														
10.5														
11.0														
11.5														
12.0														
12.5														
13.0														
13.5														
14.0														
14.5	1	1		1										
15.0	1	1		1										
15.5	2	2		2										
16.0	1	1		2										
16.5														
17.0														
17.5	1	1			1									
18.0														
18.5														
19.0														
19.5														
20.0														
20.5														
21.0														
21.5														
22.0	1	1				1								
22.5														
23.0														
Total	11	11	4	6	1	1	0	0	0	0	0	0	0	0
Mean TL			9.0	15.7	17.8	22.3								
SE			0.25	0.24	-	-								

GILL NETS				TRAP NETS				ELECTROFISHING			
1	N	41.50712	W 86.26599	1	N	41.50685	W 86.26520	1	N	41.50636	W 86.26664
	N	41.50666	W 86.26537	2	N	41.50561	W 86.26525		N	41.50336	W 86.26144
2	N	41.50543	W 86.25936	3	N	41.50256	W 86.26085	2	N	41.50366	W 86.26144
	N	41.50495	W 86.25936	4	N	41.50659	W 86.26038		N	41.50281	W 86.25802
3	N	41.50265	W 86.25957					3	N	41.50281	W 86.25802
	N	41.50275	W 86.25827						N	41.50666	W 86.26076
4	N	41.56537	W 86.26309								
	N	41.50480	W 86.26270								